Minireview Article

How malaria is ~~is malaria~~ practically eradicated in Malaysia – ~~–~~ A ~~a~~ reminiscence

Abstract

In 2010, 99 countries reported current malaria transmission, causing an estimated 219 million cases & 660,000 deaths, the deaths mostly in young children in Africa.

In Malaysia, the country started on a Malaria Eradication Programme, MEP, in the third-quarter of the past century. The MEP here is very much a success 'cos the current rate (incidence) is very low, sporadic cases in Kelantan, Selangor, Pahang, Perak and Sarawak (mostly immigrants, imported-cases and illegal-loggers) - the disease practically eradicated except in Sabah where the disease remains endemic in the interior, although here much of monkey-malaria (*P. knowlesi*) spread to human.

Vector-control played a big part in the MEP - the Anopheles spp breed in a wide variety of habitat depending on the species: drains and open pools of water (including seepage rain-water) had to be regularly and routinely sprayed with oil, and large unused-pools drained.

But, much had been achieved by residual-spraying of homes with insecticide, and the use of mosquito-net.

Residual-spraying is a big success in the reason that the Anopheles spp habitually settle (rest) on the walls after flying over to homes prior to starting on feeding. Residual-spraying only require done from time to time by a team of work. Additional protection, achieved through community-education , ~~–~~ are: wearing fully covering light-colored clothes in the evenings. Presently, mosquito-repellents can help - but these were unavailable in the MEP time.

Chemoprophylaxis (i.e. the anti-malarial drugs) should be advised fer for those travelling to and through endemic area. Armed-forces and Police-personnel were by regulation required to take chemoprophylaxis, beside such Government work.

One additional very important success measure had been Active Case Detection, ACD, and Passive Case Detection (PCD) using slide-microscope followed by prompt treatment. Such ACD & PCD reduced the size of the human-reservoir from which transmission happened.

Comment [OO1]: Abstract is 396 words. It shoud be in one piece and not in paragraphs or sections since it is a reminiscence.

Comment [OO2]: Ensure that the use of symbols as this is acceptable to he journal style.

Comment [OO3]: In full.

Key-~~word~~ words: malaria; Malaria Eradication Programme (MEP); human-malaria; monkey-malaria; Anopheles spp; breeding-habitat; primary prevention; oil-spraying; drainage; residual-spraying; community-education; chemoprophylaxis; active case detection; passive case detection.

Comment [OO4]: Too many. Please conform to journal regulations.

How is malaria practically eradicated in Malaysia – a reminiscence.

Comment [OO5]: Refer to the suggested title.

Comment [OO6]: Same.

In 2010, 99 countries reported current malaria transmission, causing an estimated 219 million cases ~~&~~ and 660,000 deaths, the deaths mostly in young children in Africa.

Comment [OO7]: Cite sources.

In Malaysia, the disease had been a scourge throughout the country's history affecting the country in every part and in every manner.

Comment [OO8]: Cite sources.

Malaria had been reported in Malaysia even before the 1900's. In 1990, 50,500 cases had been reported. In the year 2000, the number of reported-cases reduced to 12,705 cases; in 2012, totaling 4,725 cases which is found a 63% reduction. The rate has declined to not more than 1:1,000 population from the time of 1998. The number of malaria-death reduced from 43 in 1990 to 35 in 2000, and to 16 in 2012. The mortality-rate due to malaria had been around 0.001 per 1,000 population from 2006. All figures and rate are inclusive of *P. knowlesi*. The first case of *P. knowlesi* had been reported in 1965. In 2012, *P. knowlesi* totaled 38% (1813 cases) of all, that is the highest among all Plasmodium spp. in this nation.

Comment [OO9]: The source or sources of the whole of this paragraph should be properly cited with previous references to validate these information.

The early fight against the disease started prior to the country's independence spearheaded by the Institute of Medical Research with effort from the Health Ministry, the Public Work Department, the University of Malaya and various different relevant Government-agencies. Malaysia started on a Malaria Eradication Programme, MEP, in the 1960s.

The MEP here is very much a success in the reason that the current rate (incidence) is very low, just sporadic cases in Kelantan, Perak, Pahang, Selangor and Sarawak state (mostly immigrants and illegal-loggers) - the disease practically eradicated except in Sabah where the disease remains endemic in the interior of the state, although here much of just monkey-malaria (*P. knowlesi*) spread to human.

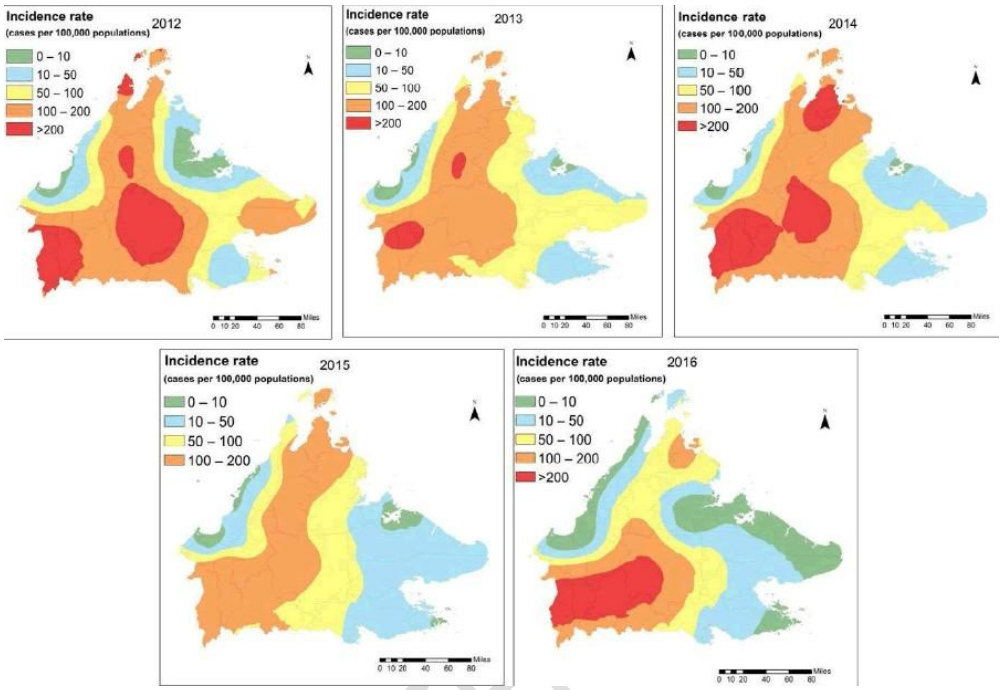

Fig. 1. Malaria infection-rate in Sabah-state, 2012 - 2016

Of the 4,725 reported-cases in 2012, 61.6% had been human-malaria with a significant proportion (38.4%) zoonotic. In human malaria, *P. vivax* stood at 50.2%, followed by *P. falciparum* (30.7%), *P. malariae* (16.7%) and mixed infection (2.2%).

Of the 2051 human-malaria cases (70.4%) had been indigenous-cases and a small proportion of 861 cases (29.6%) had been imported-cases.

Of the indigenous-malaria 74.0% had been reported from Sabah followed by 15.9% from Sarawak and 10.1% from Peninsular Malaysia. Of the zoonotic malaria, 56.9 % had been reported from Sarawak followed by 23.3% from Peninsular Malaysia and 19.8% from Sabah.

In Peninsular Malaysia, Selangor, Pahang, Kelantan and Perak reported around 100 cases in the year 2012, mainly males.

Around 8.5% of the female patients had been pregnant, and malaria had been found to cause much morbidity and mortality among the pregnant. Children beneath the age of 5 totaled 2.5% of all cases. Those mostly affected had been found in the age group of 20

– 29 year (25%). Around 61.9% of the cases had been found between the age of 20 and 49 year.

Congenital malaria is not commonly found. It could be acquired by transmission of the parasite from mother to child during pregnancy, or during child-birth. The rate (incidence), varying from 0.3 to 33%, is reported. Congenital malaria from *P. vivax* is more commonly reported in Asia, but infection from *P. falciparum* in African countries. Most newborn present with symptom between 10 and 30 days of age (range: 14hr to several months of age). The clinical sign and symptom of neonatal malaria include anemia (77%), fever (74%), liver and spleen enlargement (68%), poor feeding/lethargy/irritability, jaundice and severe thrombocytopenia. Congenital malaria could seem like neonatal-sepsis and need to be considered in the differential diagnosis of neonatal-sepsis. All newborn of the pregnant with malaria should been screened to exclude congenital malaria.

Severe malaria usually manifest with either of the following, or in combination: coma (cerebral malaria), metabolic acidosis, severe anemia, hypoglycemia, acute renal failure or acute pulmonary edema. In severe malaria, the case-fatality rate in people receiving treatment is typically 10–20%. But if had been left untreated, severe malaria is fatal in the majority of cases. Cognitive-impairment in the future is also commonly seen in children with cerebral malaria.

Comment [OO10]: As good as these information in this work are, their sources need to be indicated.

In a patient with malaria-infection, the presence of one or more of the following clinical or laboratory findings classifies the patient as suffering from severe malaria (Refer to Table 1).

Table 1: Clinical Features and Laboratory Findings in Severe & Complicated Malaria*

Clinical features	• Impaired consciousness or irrousable coma • Prostration • Failure to feed/ not tolerating orally • Convulsion • Deep breathing, respiratory distress (*acidotic breathing*) • Circulatory collapse or shock, systolic blood pressure < 90 mm Hg in adults and < 50 mm Hg in children • Clinical jaundice and evidence of other vital organ dysfunction • Hemoglobinuria • Abnormal spontaneous bleeding • Pulmonary edema (*radiological*)
Laboratory Findings	• Hypoglycemia • Metabolic acidosis • Severe normocytic anemia • Hemoglobinuria • Hyper-parasitemia • Hyper-lactatemia • Renal impairment

*Source: Health Ministry Malaysia, 2014

Plasmodium falciparum is still the predominant species at 69.6%. The case-fatality rate in 1990 had been 0.09%. There had been 43 deaths all of which had been totally attributed to cerebral malaria.

Thus, malaria in Malaysia had been practically eradicated as aimed. What is the reason ~~that~~ for the success case of the MEP in Malaysia ~~happened in Malaysia~~?

Primary prevention is seen in two areas: Health promotion and specific protection. In the case of the MEP, vector-control played a big part - the Anopheles spp. breed in a wide variety of habitat depending on the species: drains (mostly open storm-drains and culverts) and open-pools of water (including seepage rain-water) had to be regularly and routinely sprayed with oil, and large unused-pools drained - both by Public Work Department (PWD) work and health work.

But importantly, much had been also been achieved by residual-spraying (the walls) of homes/houses with insecticide (much of it, cheap DDT, which is still allowed today in the reason of health), and the use of mosquito-net (there did not seem a need to impregnate such nets with insecticide, but needed to be put up at dusk itself). Holed-nets needed prompt repair.

The Anopheles spp. ~~bite~~ bites ~~-~~only at night (mostly while sleeping) and some at dusk. Residual-spraying is a big success in the reason that the Anopheles spp. habitually settle (rest) on the wall after flying over to homes prior to (the females) starting on feeding. Residual-spraying mean the insecticide remain on the wall a length of time after spraying - thus, residual-spraying only require done from time-to-time (in cycles) by a team of work.

Additional protection, achieved through community-education~~,~~ ~~-~~ are: wearing fully-covering light-colored clothes in the evenings. Presently, mosquito-repellents can help - but these were unavailable during the MEP-time.

Chemoprophylaxis (i.e. the anti-malarial drugs) should be advised in those travelling to and through endemic area. In the past and during the MEP Armed-forces and Police-personnel had been by regulation required to take chemoprophylaxis, beside such Government work.

Chloroquine, proguanil, mefloquine, and doxycycline are suppressive-prophylactic - they are only effective at killing the malaria-parasite once it has entered the erythrocytic-stage (blood stage) in the life-cycle, and thus have not any effect until the liver-stage is complete. Thus, these prophylactic must continue to be taken a month still after leaving the area of risk.

Causal-prophylactic targets ~~target~~ ~~-~~not only the blood-stages of malaria, but the initial liver-stage also - the user may stop taking the drug seven days after leaving the area of risk. Atovaquone/Proguanil (Malarone) and primaquine are the only causal-prophylactic in current use.

One additional very important success-measure had been Active Case Detection, ACD, (on healthy people, by active incursions of little-trained medical-personnel bringing back labeled blood-slides to examine under microscope) and Passive Case Detection (PCD) (those coming to medical/health centers suspected of malaria) using slide-microscope (blood-film, but here today rapid serological-tests are also available) followed by prompt treatment using anti-malarial drugs. Such ACD & PCD reduced the size of the human-reservoir (the infected and diseased hosts) from which transmission happened.

A classical-case of little-trained personnel helping in had been the training of long-house village-headmen in Sarawak found trained in obtaining preparing blood-film slides to be collected by health-officers.

Common anti-malarial used during the MEP were chloroquine, primaquine, sulfadoxine-pyrimethamine (Fansidar), mefloquine and quinine (particularly in severe malaria including cerebral malaria).

Although here in Malaysia, the concept of eradication had changed to one of control in the early 1980s, anti-malaria activities had remained the same. But, additional supplementary-activities such as the use of impregnated bed-nets, and the Primary Health Care approach, became introduced in malarious and malaria-prone area.

The problems faced in the prevention and control of malaria include such associated with the opening of land for agriculture and immigrants (legal and illegal), beside nomadic-movement of the aborigines of Peninsular Malaysia.

In Malaysia, malaria is a notifiable-disease under the Communicable Diseases Control Act 1988 that here mandate notification within a 7 day period. But, to facilitate early investigation and implementation of control-measures, all practitioners are required to notify malaria-cases to the nearest health office within a day.

In 2011, the Malaria Control Programme again became re-oriented from control to elimination, and the Health Ministry produced the National Strategic Plan for the Elimination of Malaria (NSPEM) (2011 – 2020) - with the aim of eliminating indigenous human-malaria (only) by 2020.

Seven strategies are outlined in the NSPEM (2011 – 2020) :

- strengthen the Malaria Surveillance System
- intensify control-activities using the Integrated Vector-Management approach
- early-detection of cases and prompt-treatment
- heighten preparedness and early-response to outbreak
- enhance community become aware and knowledgeable on malaria toward social-mobilization and empowerment
- strengthen the human-resource capacity, and
- conduct relevant research.

One of the seven main-strategies is early-detection of cases, and prompt treatment that require the use of Artemisinin-based Combination Therapy (ACT) as first-line treatment in all species, resistance to anti-malarial ~~malarials~~ being found as a problem in this.

Resistance to anti-malarial has been documented in *P. falciparum, P. malariae and P. vivax*. In *P. falciparum*, resistance has been observed to all currently-used anti-malarial (amodiaquine, chloroquine, mefloquine, quinine, and sulfadoxine-pyrimethamine) - recently yet, in artemisinin-derivatives in certain area of the world. The geographical-distribution and rate-of-spread of anti-malarial drug-resistance have varied much.

Comment [OO11]: This part of the statement is hanging, Revisit.

P. vivax has developed resistance rapidly to Fansidar (sulfadoxine-pyrimethamine) in many ~~area~~ areas, while resistance to chloroquine is seen largely in South-east Asia and various parts of Oceania. There is also found report on resistance from Brazil and Peru.

Chloroquine-resistant falciparum-malaria had been first reported in Peninsular Malaysia in 1963. Studies on chloroquine-resistant falciparum-malaria in the 1960s to 1970s revealed the range of resistance-rate from 3.9% to 50.7%, most of it being mild R1 type.

A study in Peninsular Malaysia in 1993 documented the overall resistance to chloroquine as 63.3% and to Sulfadoxine-pyrimethamine as 47.4%. RI, RII and R Ill1 rate in chloroquine had been 9.1%, 42.4% and 12.1% and in sulfadoxine-pyrimethamine they had been 10.5%, 21.1% and 15.8%. Degree and rate-of-resistance to chloroquine had been found significantly correlated with pre-treatment parasite-density, but not those to sulfadoxine-pyrimethamine.

The classification of resistance are: RI, Delayed Recrudescence i.e. the asexual-parasitemia reduces to < 25% of pre-treatment in 48 hours, but reappears between 2-4 weeks; RI, Early Recrudescence i.e. the asexual-parasitemia reduces to < 25% of pre-treatment in 48 hours, but re-appears earlier; RII Resistance i.e. marked-reduction in asexual-parasitemia (decrease >25% but <75%) in 48 hours, without complete clearance in 7 days; RIII Resistance i.e. minimal-reduction in asexual-parasitemia, (decrease <25%), or an increase in parasitemia after 48 hours.

Malaysia should be expected to totally eradicate human-malaria by 2020, in case the nation is found here to stay on in the present direction.

Conflict of Interest: The author declares no conflict of interest. ~~exists~~.

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Comment [OO12]: Author should ensure that this references follow journal requirements.